Volume 3, Issue 2

MPOver-drive

High Point Urban Area Metropolitan Planning Organization

Basics of the 4 Step Transportation Model

The four MPOs in the Piedmont Triad Region (High Point, Winston-Salem-Forsyth County, Greensboro and Burlington), in cooperation with the Piedmont Authority for Regional Transportation (PART) and the NCDOT Statewide Planning Branch, have begun work on an update of the Piedmont Regional Travel Model. This model will use the latest modeling software as well as updated demographic data from the 2000 Census. This issue will give a brief overview of the travel modeling process. The information in this article was first published in the Spring 2003 edition of "metros", a newsletter of the Association of Metropolitan Planning Organizations.

Over the past 10 years, Transportation Modeling has moved well beyond a tool just for investment decision-making. It has become a key component in efforts to improve, maintain and prevent backsliding in terms of regional air quality.

The 1990 Clean Air Act Amendments (CAAA) thrust metropolitan planners, most specifically the modelers, into the then new arena of air quality compliance. While the application of the transportation modeling process has expanded, its basic form has not.

Transportation Modeling (also know as Travel Demand Forecasting) estimates travel on the transportation system and gives a preview of travel on proposed facilities. Travel patterns are based on relationships developed from survey data between employment sites, housing, and transportation facilities. Forecasts assume that travel patterns will stay the same for a given period and can therefore demonstrate future travel flows.

Inside this issue:

4 Step Model — 1
Traffic Calming — 3
MPO Staff — 4

What makes up a Model?

Network

The network consists of an abstract of the travel system. The roadway is a simplified representation of streets that provide for general circulation within a given region. It is based on a system of nodes and links. Nodes are generally street intersection points, while links connect the nodes and represent streets and provide information on operating characteristics such as type and length of facility, number of lanes, etc. Also represented are gateways or cordon stations.

Socioeconomic Data

The amount and type of travel depend on the land use parameters input into the model. Traffic Analysis Zones (TAZs) are the analysis units of the model. Land use data are incorporated into TAZs, which range in size. Boundaries generally include the regional network area and natural or manmade dividers, such as canals and railroads, which naturally limit opportunities for trip crossings.

Land use is described in terms of type, intensity and location. This data is used in the trip generation process to estimate factors such as the number of trips that a household or employee will produce. Data is developed for a base year, say 2000, and various forecasts. Household data includes population and is often broken down into various categories such as single-family households with two or more autos or multiple family households with no autos.

In simple terms, the four steps are the following (1) trip generation, (2) trip distribution, (3) mode choice, and (4) trip assignment. Working on a regional basis, the models are complex computer programs that use equations to link large amounts of data. Each equation includes assumptions about how the transportation network operates. Incorporated in this theory are assumptions about travel demand and system capacity of both roads and transit.

Trip Generation

Trip generation takes socioeconomic data, and based on historical survey information, estimates the number of person trips produced and attracted within each Traffic Analysis Zone (TAZ). These trip productions and attractions are generally called "trip ends".

Trip Distribution

Trip distribution determines where a trip develops and where the trip will go. Trips are connected between TAZ-based data previously input into the model. Trip generation assumes a person is more likely to travel to a nearby zone with many amenities such as employment, shopping, etc. than to a further zone with few amenities.

Known as a "gravity model" this process derives its name and basic working premise from Newton's law of gravity, which states that:

The attractive force between two bodies is directly related to their size and inversely related to the distance between them.

Therefore, the number of trips between areas is directly related to the level of land development within each TAZ and inversely related to the distance (miles of travel) between the TAZs. Distance is expressed as miles of travel.

Mode Choice

Mode choice predicts how a trip will be taken. Will it be by foot, bike, automobile, mass transit, a ferry or some other means?

Characteristics of the trip maker (income, gender, etc.), trip purpose (shop, work, etc.) and the mode (cost, time, etc.) all affect the mode choice decision process.

Trip Assignment

After applying vehicle occupancy rates and balancing the production and attraction trip matrix, the resulting "origin/destination" matrix is assigned to the network.

Model Output

Results of the "4-step process" are reports identifying traffic impacts on the overall system and each street segment measured by the relationship of the facility capacity to facility volume. Information is available for the following whether as a table or as plotted data:

- vehicle miles of travel (VMT),
- vehicle hours of travel (VHT),
- number of trips,
- trip length,
- hours of delay,
- congested speeds,
- congested travel times,
- directional and non-directional daily and peak hour volumes,
- bandwidths, and
- volume/capacity ratios (V/C).

Traffic Calming

The Institute of Transportation Engineers (ITE) defines traffic calming as "The combination of mainly physical measures that reduce the negative effects of motor vehicle use, alter driver behavior and improve conditions for non-motorized users." The purpose of traffic calming is to reduce speed and volume of traffic to acceptable levels ("acceptable" for the functional class of a street and the nature of bordering activity). Reductions in traffic speed and volume, however, are just means to other ends such as traffic safety and active street life.

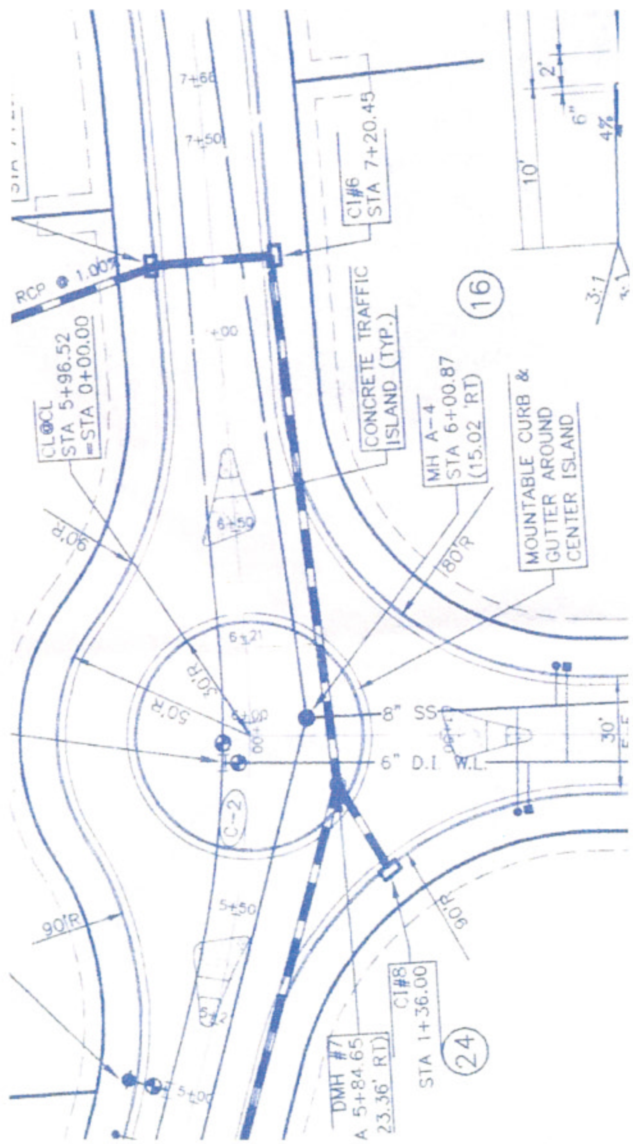
Traffic calming devices that are designed to reduce speeds can be divided into three categories: vertical, horizontal and narrowings. Vertical traffic calming devices provide variation in pavement height and materials that typically cause discomfort to the occupants of vehicles operating in excess of the desired travel speed. Most vertical traffic calming measures are considered undesirable for primary emergency response routes and transit routes. Textured pavements, speed humps, speed tables, raised crosswalks, and raised intersections are all examples of vertical calming devices.

An example of a chicane located on Johnson Street, High Point.

Horizontal traffic calming devices use items such as raised islands and traffic circles to eliminate straight-line travel, thus forcing most drivers to reduce their speeds. Horizontal devices can also be used to reduce pavement widths to discourage speeding or to restrict passage to a single lane, thereby significantly reducing the capacity of the roadway. Traffic circles, roundabouts, curb extensions, chicanes, lateral shifts, realigned intersections, chokers, center island narrowings, and medians are examples of horizontal calming devices.

Narrowings use a sense of enclosure to discourage speeding. Narrowing is usually accompanied by plantings, street furniture, or other vertical elements to draw attention to the constriction and visually bind the space. Neckdowns, curb extensions, bulbouts, and safe crosses are examples of narrowings.

Research has revealed a variety of advantages and disadvantages of traffic calming devices. Increases in emergency response times, slowing of emergency vehicles and buses, potential drainage problems,



Roundabout as designed by Jamestown Engineering for the Cameron Park Subdivision.

Example of a speed table.

An example of a speed hump.

increased noise from acceleration, difficulties in snow plowing, and bicycle/auto conflicts have been identified as some of the disadvantages. The potential for those disadvantages requires that special considerations be made. Traffic Calming on thoroughfares should be used to reduce speeds without reducing capacity or diverting traffic to other streets. Also, placement of traffic calming devices should discourage sudden acceleration. The advantages have been identified as reduced speeds, reduced traffic volumes, and increased pedestrian visibility, which are welcome tradeoffs to citizens when compared to the disadvantages.

Metropolitan Planning Organization Staff

Andy Grzymski, AICP
Transportation Planning
Administrator
(336) 883-3233
andrew.grzymski@ci.high-point.nc.us

Craig Hughes
Transportation Planner
(336) 883-3310
craig.hughes@ci.high.point.nc.us

Cheryl Edwards
Transportation Technician
(336) 883-3235
hymie.edwards@ci.high-point.nc.us

City of High Point
Department of Transportation
P.O. Box 230
High Point, NC 27261
(GZK)

To plan for the provision of integrated and efficient transportation facilities and services in the High Point Urban Area, while ensuring the highest possible level of community participation in the transportation planning process.